Zero Retries issue 0011 2021-09-24

Advanced Amateur Radio - Data Communications; Space; Microwave… the fun stuff! Nothing great has ever been accomplished without irrational exuberance. **Tom Evslin**. ***Irrational exuberance is pretty much the business model of Zero Retries.*** **Steve Stroh N8GNJ** ***The Universal Purpose of Ham Radio is to have fun messing around with radios.*** **Bob Witte K0NR**

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Request To Send

By Tuesday of this week I had the next couple of issues of Zero Retries queued up to publish. My workflow is to look at the upcoming issue several times in the week immediately prior to publication, and those two upcoming issues just felt… *heavy*. One was a topic I enjoyed exploring, but in the end was kind of speculative, and the other topic was no fun, but I think deserves a serious discussion. The other "whole issue topic" I had in queue was the Long, Imperfect Specification for RAMA, and I was hoping to get some interest from Zero Retries readers to review it prior to my publishing it. But reading a spec is a necessary evil for development, not something to be read casually for fun, thus I'll probably make that a special issue or publish it outside Zero Retries.

Eventually I decided this issue needed to be a bit lighter, and I decided to catch up on several

smaller, lighter topics - mostly recent conferences.

QSO Today Virtual Ham Expo Presentations - August 2021

True to their word, the QSO Today organization has made public all the presentations from their August 2021 virtual event. I was really impressed with several presentations in particular:

- Alan Thompson W6WN - Phones, Fires and Failures and his followup Radio For The Rest of Us - with Questions and Answers. He proposes that Amateur Radio clubs ought to embrace sponsorship of General Mobile Radio Service (GMRS) for emergency communications for those that want emergency communications, but not the baggage of Amateur Radio. In my opinion, he makes a compelling case.

- Erik Westgard NY9D - Build a Mesh Tower Generator Trailer Fleet for Public Service - with Questions and Answers. His idea is kind of the magic bullet that makes high speed microwave networking in an rapid deployment emergency communications situation practical and usable.

- Feng zhao BG0AUB - BG0AUB's QO-100 Satellite QSO/DIY Journey - with Questions and Answers. I can't get enough info about QO-100 operating. I wish I could operate QO-100 in person. I guess I could - just move to Europe :-)

- Joshua Carroll AA5JC - The First Fully Automated Repeater Coordination Service for Ham Radio - with Questions & Answers. There has to be something better than self-appointed good old boys sitting around divving up the Amateur Radio VHF / UHF spectrum in perpetuity.

- Katherine Campbell KE8LQR - STEM in action: Having fun with school amateur radio clubs. We need far, far more of these kinds of activities, and presentations about them!

- Orv Beach W6BI - Using AREDN Software to Create a Ham Radio Network. W6BI is now very experienced at promoting AREDN, and this presentation is up to his usual standards. It's an excellent overview of AREDN if you aren't familiar with it.

There were many more presentations that I intend to watch. What's different about these videos is that they were created as formal presentations, not as a "it seems to me, let's wing it" videos so common about Amateur Radio on YouTube. They aren't perfect by any means (widely varying production quality), but they try to present their subject in a structured way, and to me, that makes them a lot more watchable.

QSO Today also offers the presentations from their August, 2020 and March, 2021 Virtual Ham Expos. My thanks to Eric Guth 4Z1UG (and staff?) for creating the QSO Today Virtual Ham Expo and making all of these great presentations available for public access. The next one is scheduled for March 13-14, 2022.

Thoughts on the 2021 ARRL and TAPR DCC

The 2021 ARRL and TAPR Digital Communications Conference (DCC) was held virtually Friday September 17th and Saturday September 18th, 2021. It's a polite fiction that the ARRL has much involvement with the DCC other than the formality of the (Print on Demand) Proceedings, which have been handled incredibly competently, *for decades now*, by Maty Weinberg KB1EIB at ARRL. In actuality, it's been the TAPR DCC for more than a decade now, but TAPR prefers to include the ARRL as a formal part of the conference name.

TAPR's method for conducting virtual DCC's is for the primary conference system to be Zoom, which allowed a large number of "interactive attendees" (paid attendees, TAPR members, presenters, and DCC staff) and then the output was livestreamed to YouTube (no payment required, but not interactive). Here are the YouTube links for the two days:
TAPR DCC 2021 Friday session
TAPR DCC 2021 Saturday session
Overall, the combination of Zoom and YouTube worked well to be able to see the presentations. Unfortunately, TAPR still hasn't mastered being able to have a DCC web presence for posting the submitted papers and other parts of the "experience". Even now, days later, the only detail available about the 2021 DCC on the TAPR website is the schedule.

It was good to see that most of the DCC was about actual research. Much of Friday was taken up with discussion about Ham Radio Science Citizen Investigation - HamSCI, including hardware that TAPR is developing specifically for HamSCI use.

Four presentations were particularly interesting to me:

- **A Tale of Two Meshes** by Erik Westgard NY9D. NY9D made a compelling case for operating a Part 15 wide area network using Wireless Internet Service Provider (WISP) equipment in parallel with Part 97 AREDN equipment. They use the Part 15 network for sensitive data such as health data that requires encryption and security. They use the Part 97 network for "the usual Amateur Radio activities". NY9D also wrote a paper for the DCC Proceedings.

- **ARDC – Grants and the Amateur Radio Internet** by John Hays K7VE. K7VE gave an overview of ARDC's activities to date, some basic guidelines on grant proposals to ARDC, and a brief discussion of activities for Net44.

- **The KA9Q-Radio Package** by Phil Karn KA9Q. As I (probably imperfectly) understand it, KA9Q-Radio virtualizes the output of a software defined by using IP multicasting to distribute the IQ data from the radio (10 MHz slice of spectrum) to multiple decoders running in parallel. Thus one decoder can decode FM voice, another decoder decodes packet radio, etc. all from the same software defined receiver. KA9Q-Radio was the most exciting thing I heard about at the 2021 DCC (including my presentation). KA9Q also wrote a paper for the DCC Proceedings.

- **Multipurpose Remote Nodes** by Steve Stroh, N8GNJ, Andy Sayler, KF7VOL. I discussed MRNs in Zero Retries 0010. Unfortunately, our 2021 DCC presentation didn't come out too well. About eight minutes or so into our twenty minute prerecorded presentation, the audio began glitching badly. Something went wrong on TAPR's end, and we had to scramble to do a live narration to the presentation slides, which I was unprepared to do. Fortunately KF7VOL was more prepared than I was. Our prerecorded

> presentation is now posted on YouTube, courtesy of Budd Churchward WB7FHC (who did an incredible job of editing that video into a watchable presentation that was seconds under the 20 minute maximum that TAPR requested).

TAPR cleverly offered "virtual attendee" pricing the same as annual membership in TAPR - yep, that was a deliberate ploy. Given that I highly value the DCC, I need to restart my membership in TAPR… as soon as I get over the "ugh… I have to create *yet another* online account…" fatigue.

GNU Radio Conference 2021

It's just *cool* that there is such an event as GRCon21, and that it extends for a solid week - September 21-24, 2021. Not to mention that it's so well attended, and so well sponsored. GRCon21 is being conducted hybrid in person (Charlotte, NC) and virtually. That's not easy, but it's entirely doable when you can hire professionals to do the audio / video and streaming work.

It's really, really cool (Zero Retries cool!) that GRCon21 includes two Amateur Radio license examination sessions! We need more techies in Amateur Radio like GRCon attendees; I hope someone is able to capture those that do get licensed at GRCon21 and engage them in some meaningful (to them) activity in Amateur Radio.

Besides the license examinations, here are some other highlights of GRCon21 for me that I'll be watching post-conference on YouTube:

- **PlutoSDR Workshop**
- **GNU Radio and SETI - A Growing Collaboration**
- **Deep space reception by AMSAT-DL**
- **Demonstration of GNU Radio High Data Rate BPSK 10 Mbps Modem Real-Time with Only Multi-Core General Purpose Processors**
- **Breakout session on GNU Radio Documentation**

One of these years…

Kudos to the GRCon organizers, and especially kudos to inclusion of talks that are interesting and relevant to us Amateur Radio Operators that are curious and interested in GNU Radio.

KB6NU - Why aren't more hams using GNU Radio?

Dan Romanchik KB6NU's blog post on 2021-09-21 asked this reasonable question.

> Let's just say for the moment that I'm right. What do we need to make GNU Radio more popular and used in the amateur radio world? The first thing I think we need

> is more basic DSP training. Again, if there are course out there—perhaps on Coursera or some similar learning platform—please let me know.
>
> Second, I'd say we need a "GNU Radio for Dummies." This book/online course/set of videos would not only introduce hams to GNU Radio, but use as an example some simple radio, say a 70 cm FM transceiver.The hardware for this training course could possibly be the ADALM-PLUTO. This devices has a frequency range of 325 MHz to 3.8 GHz, and Analog Devices says, "[The ADALM-PLUTO] helps introduce electrical engineering students to the fundamentals of software-defined radio (SDR), radio frequency (RF), and wireless communications. Designed for students at all levels and from all backgrounds, the module can be used for both instructor-led and self-directed learning to help students develop a foundation in real-world RF and communications that they can build on as they pursue science, technology, or engineering degrees." What's more GNU Radio has very good support for the ADALM-PLUTO.

I envy KB6NU for attending GNU Radio Conference. I've wanted to do the same for years now, and given that for the last few years, they're held (loosely) in conjunction with the ARRL and TAPR Digital Communications Conference, perhaps one of these years.

KB6NU posits that first we need more accessible Digital Signal Processing (DSP) training. Perhaps that's within his capabilities, but by now I know my limitations, and creating new DSP software is simply outside my capabilities. But I don't think that's critical. In the late 1980s, there were darn few of us who could meld together TCP/IP and AX.25 the way Phil Karn KA9Q did when he released his original NET and later NOS software that let us run TCP/IP over AX.25 in Amateur Radio. Once Phil had created NET and NOS and released it in a usable form, I was happily a "mere user", and I expect the same situation would occur with a "GNU Radio for Amateur Radio Dummies".

As I discussed in Zero Retries 0007, like KB6NU, I feel that GNU Radio and the ADALM-PLUTO are complementary. But both suffer from a major stumbling block - no easy way to make them usable… no "training wheels" mode to get people comfortable. In the case of GNU Radio, I haven't found a "GNU Radio for Amateur Radio Dummies" tutorial, preconfigured Amateur Radio packages, etc. I'm sure they're out there - I just haven't found them. As I discussed, there is GNU Radio Companion, which is a graphical front end to GNU Radio which offers some possibilities.

As for the ADALM-PLUTO, it suffers from puny power output (that's a feature, so it can be powered from USB) meaning that it works great across the workbench, but getting enough transmit power even to drive a power amplifier requires a "driver amplifier" and I haven't yet found a driver amplifier that is verified to work. As I noted, there's no shortage of driver amplifiers on Amazon, eBay, Alibaba, etc. - just bring money and patience to sort through them and find one that actually works without causing problems (harmonics, etc.).

It seems to me like creating something like "GNU Radio for Ham Radio Dummies" would be a great project for a Ph.D. dissertation or Senior Project for an Electrical Engineer in training. That approach worked out quite well for Matt Ettus N2MJI who founded Ettus Research and created the Universal Software Radio Peripheral (USRP).

A Basic Emergency Power Supply

The topical conversation is the aftermath of Hurricane Ida devastating much of Louisiana, and the resulting widespread power outage. What struck me was that there were so many people that said "I can't charge my phone" and thus they couldn't call 911, text relatives, access websites or social media for information, etc.

Most people think that a generator, even a small one, is the logical solution to this issue, but of course, generators need fuel, maintenance, and they're deadly dangerous because many people just don't understand that a generator's exhaust can kill in a confined space. People don't want to leave generators outside because they can (and often will) get stolen. Some people charge their phones in their cars (and think that they have to run the engine to do so). Unless you don't have a car, or it's flooded, or out of gas.

Yes, you can buy "Power Stations" that integrate a battery and USB and 120V AC outputs, but those are engineered to be lightweight and sexy-looking. In my opinion, a decent one is pretty expensive ($500), has very little capacity, and they're rarely fully charged and ready to go when you need them most.

So here is a gentle suggestion for your relatives and friends that are in harm's way and really, really need to be able to use their mobile phone during an extended power outage. Use your technical expertise to put together a system that automatically charges a large 12 volt battery, and provides 12 volt output sufficient for charging phones (with various adapters). Such a system will stay put in one place (it's heavy) and stay plugged in so that the battery remains fully charged. I put together such a system for my radios and "shack computers" with components such as these from West Mountain Radio, but that's overkill for "civilians".

I began this article by specifying some components, but the choices of individual components for this system are infinite. Thus, use your technical expertise to choose the ones that fit your circumstances and budget.

Start with the battery. I chose a large (auto-size) "Gel Cell" battery so that there weren't any issues with it being inside (minimal gassing). I put it in a plastic battery case and tucked it under my radio desk. Prices for such batteries range from reasonable to absurd. Buy as much battery as you can… and can move (they get heavy). Moving it might be a big deal if you might need to take it somewhere to charge it. If you can, include a lifting strap so it can be moved "reasonably" easily.

Yes, there are high-capacity Li-Ion and other battery chemistries that result in a lightweight, high capacity battery that can more easily be moved. But they're expensive, and if charged incorrectly… explosive. Thus I opted for, and recommend, plain old sealed lead acid (gel cell). This is intended as a stationary system, thus weight isn't nearly as much of a factor.

If this system will be indoors, please don't cheap out and use a conventional auto or deep cycle battery that will vent hydrogen gas when charging. If you're going to do this, buy components that will be safe and reliable such as "gel cells" batteries.

Next, add a trickle charger to keep the battery charged. The easiest and least hassle is to use a 120V AC trickle charger. You can also get integrated solar panel chargers for 12 volt batteries.

That might be a better choice for disaster-prone areas.

Last, connect multiple "cigarette lighter sockets" to the battery. I know - those totally suck. The only argument for using them is that they are universal. If you shop carefully, you can get cigarette lighter sockets that are of reasonable quality.

Lastly, include a 12 volt (cigarette lighter plug) multi-port USB charger like you use in a vehicle for powering multiple devices, like two kids in the back seat each with their own tablet. Or two.

Please - put some well-chosen fuses in the system, just in case. And include spare fuses, just in case.

Depending on your choice of components, this system could easily cost under $100 depending mostly on the choice of battery. The system will sit in a corner, ignored, until there's a power outage and it's needed as the only way to charge up mobile phones, tablets, etc. If it's used sparingly only for charging up small devices, it could easily last a week. With a small solar panel tucked into a window, it could last much longer. My personal timeline is to swap out the battery every five years or so.

Extras you might want to include:

- An LED light that operates on 12 volts. You can spend a lot of money on these (designed for boats or campers). An alternative is to buy 12 volt LED light bulbs for standard light bulb sockets and convert an inexpensive desk lamp into operating on 12 volts using such bulbs.

- Small 12 volt to 120V AC inverter. These are handy for things like charging unique batteries for cameras, etc. that can only be charged from 120V AC.

- Small television that operates from 12 volts. Don't forget to have some kind of antenna.

- USB extension cables and various USB cables for charging a variety of devices. Once word gets out that you have the ability to charge up phones in a power outage, you'll quickly have lots of friends.

- Maybe make provisions that the battery can be charged in a vehicle by plugging it into the vehicle's cigarette lighter socket. If you choose to do this, use some kind of charging regulator because connecting a discharged battery to a cigarette lighter socket will pull a huge amount of current and at best, blow a fuse, and at worst, melt some wiring and cause a fire.

- A small kit with rechargeable AA batteries for personal flashlights. Buying a "Costco" blister pack of AA alkaline batteries is a reasonable precaution, but my experience is that if you don't use such batteries after a year, many just go bad.

The New York Times Wirecutter had some recommendations for individual units such as generators, UPS, surge suppressor power strips, etc.: The Best Power Outage Tools and Supplies.

Or… you could just buy a Ford F-150 Hybrid and use that as a power source to keep living life pretty normally, including your refrigerator and television.

AMSAT-NA Searches the Sofa Cushions for Funding for Next Few FM Repeater EasySats

In his editorial (Apogee View) for July / August 2021, AMSAT-NA President Robert Bankston KE4AL wrote about the difficulties of creating and funding the next generation of "EasySats", very small FM repeater satellites in low earth orbit:

> Every satellite project requires both people and funding. As mentioned already, all of our engineers are consumed by our GOLF program. This leaves us with either open-sourcing the project or purchasing a commercial, off-the-shelf satellite. Open-sourcing would work for the initial design process; however, there is no current precedent to allow the open-source building of a satellite under U.S. Export Administration Regulations (EAR).
>
> While there are many commercial companies that offer complete off-the-shelf 1U CubeSat platforms, only one includes an FM repeater that meets our mission requirements. Purchasing a ready-to-fly CubeSat seems to be our best course of action, given AMSAT engineers' focus on GOLF, but it comes at a cost.
>
> Two 1U FM CubeSats (flight model and flight spare), a 1U FM CubeSat engineering model (without solar panels) and a 500 KM, Sun-synchronous orbit launch will cost just over $283,000. Each additional launch, one every three years, will cost approximately $138,000, as we would only need to purchase one CubeSat and the launch.
>
> So that leaves us with the big question – How are we going to pay for it? An FM satellite provides a world-wide benefit. Therefore, we need to conduct an international fundraising campaign, partner with other AMSAT organizations, and request funding from other organizations.
>
> The benefits of providing a sustained FM presence in LEO to promote and support amateur radio in space far outweighs the costs, especially when we implement a plan that allows our AMSAT engineers to continue their efforts on our path Onward & Upward.

In my opinion, what's sad about this appeal is that it's obvious that KE4AL is being disingenuous at best, deliberately obtuse at worst, on how to obtain such funds in short order. By now, ARDC's Grantmaking Program is well known within Amateur Radio.

Regarding KE4AL's statement

> Open-sourcing would work for the initial design process; however, there is no current precedent to allow the open-source building of a satellite under U.S. Export Administration Regulations (EAR).

In an article published 2021-09-23 - Open-Source Amateur Satellite Work Not Subject to Export Administration Regulation, ARRL and Open Research Institute apparently beg to differ on KE4AL's "understanding" of the usefulness of Open Source in Amateur Radio satellites.

Feedback Loop

Bill Buhler - AF7SJ, regarding Zero Retries 0006 - Something of a Plan for Creating RAMA and A Brief, Imperfect Specification for RAMA:

> On your talk about a VARA development, I wonder if you have run into ARDOP? There is a fascinating thread about it recently on the PAT forum (PAT is an open source WinLink clone). The ARSFI has abandoned WINMOR and ARDOP which they initially sponsored because VARA has continued to improve and they grew discouraged when their embedded ARDOP2 code proved sensitive to HF tuning errors. What's fascinating is that the non embedded version of ARDOP2 which was used by PAT does not suffer in performance if the tuning is off.
>
> I suspect that ARSFI found it was easier to focus their limited funds on developing their core system / network instead of developing software defined modems. But the ARDOP spec has been used successfully by many of the Linux based hams, and I'm sensing growing frustration that it is being abandoned.
>
> The latest versions of ARDOP, which are no longer being actively maintained go for full OFDM modulation, and I suspect could give VARA a real run for its money. Because WinLink's ARSFI group gave up due to bugs in their implementation of ARDOP version 2, no one really got experience using ARDOP OFDM, and now the author is moving on. It is however a open source project with full documentation.
>
> Over in Australia the CODEC 2 team has started developing a couple of modem projects stripping the HF modem code out of their FreeDV project and using it to send data packets. Their approach is FSK, which Mr Rowtel is fascinated with the low S/N ratios we can achieve in that mode. There is a group that is doing IP over the modem now with Linux based hardware and Raspberry Pi computers as the transmitters:
>
> https://www.rowetel.com/?p=7207
>
> My only concern with FSK is the FCC's ancient part 97 rules where they tried to constrain the bandwidth of a signal by limiting the baud rate....
>
> So without spending a lot of effort reverse engineering a closed system, I believe we have two opensource projects that could be used / improved upon to reach your goals without having to start over and reinvent the wheel. I encourage you to dive [in] and and see if you agree with me.
>
> On the subject of radios, I think I have a unique perspective on what direction we

should go, informed by my carer as a network technician who rode the wave of VoIP. As you mentioned in your last newsletter you want to build a network. I agree, but I don't believe the components are as important as the protocols we put in place. The Codec 2 enthusiasts have shown that they can modulate a signal using the PWM chip on a Raspberry Pi with a range of several miles. Power is nice for filling in the dead spots, but initially we can build networks with low power + good modulation, some Forward Error Correction and good antennas. But who will use it and why?

Voice was the killer application for decades of amateur radio, and while highly inefficient requires the least of the end user. So why don't we build our digital networks to support voice? Hear me out. If I have a data rate of 19.2kb of data, I can carry roughly four simplex voice channels over it. But voice in ham radio has gotten spotty, often only a few hours a day usage on a given repeater. If I got to 38400 we now have eight potential voice channels, but one, I mean one very slow by today's standards data link. Therefore voice is cheap compared to data. So if we build a data network that has built in prioritized voice and SMS services we could reduce the resistance to tying up repeater pairs with data. Instead we could be offering the voice users a "trunked" repeater backbone. Tie it into one of the DMR or Fusion networks and people could subscribe to a talk group on their radio. When a channel is idle it could be busy talking with the data modems out there, handshaking and grabbing every available channel for a quick burst of data.

On protocols. I love IPv4 and IPv6, which were really well designed for always on / up low latency quick turn around links... The opposite of our radio networks in many ways. Yes many have run IPv4 on the network, and if we leverage Wi-Fi or similar techs they work very, very well. But for VHF and UHF we also have too much latency in the radio hardware to achieve good speed. Plus the overhead of modern IP applications will make what are often simple things take a very long time.

But we can have some fun here as well. With TCP or higher We could completely replace layers 1-4 with a radio network proxy and push streams of data over the network with proxies on each end converting between IPv4 or IPv6 and our more suited for radio packet format.

AF7SJ - It's fascinating conversations like this that “pay” for all the work I put into Zero Retries. Thanks! I think that these functions ought to be co-equal on any future Amateur Radio system:

- Non-realtime file transfer / data
- Realtime text messaging - one to one
- Realtime text messaging - one to many (broadcast)
- Realtime digital voice
- Maybe even digital video (probably low resolution)

I'm more of a fan of text than voice (though I'm comfortable with both). Here in Whatcom County, Washington we have a great time on Sunday mornings 09:00 to 09:30 (or later) using fsq at 6 cps (no typo - 6 characters per second) on VHF. It's a terrible waste of bandwidth, but we all have 2m FM radios that otherwise aren't doing much. It would be so much better if we had all mode 2m radios that could do SSB, but work with what we have for now. To your points:

- ARDOP - I was aware of it, but I was not aware of the continuation of its (active) development as open source. Cool, and noted! ARDOP (The Next Generation) should definitely get some additional attention!

- ARSFI could easily continue / accelerate development on ARDOP with a grant from ARDC.

- The FCC rules are a bogeyman that frightens way too many people. I've developed an approach to asking for forgiveness rather than permission for advanced experimentation (like New Packet Radio doing 500 kbps in a 100 kHz channel; I'm *still* going to occupy the same 100 kHz channel - why should I *retard* my signal to a mere 56 kbps when for the same 100 kHz I can achieve 500 kbps?

- I think that Special Temporary Authority grants and Experimental Licenses from the FCC are underutilized resources in Amateur Radio. We're supposed to be experimenting! It would be cool if there was a group that offered help and encouragement and experience for starting for STAs and Experimental Licenses in Amateur Radio.

- I'm fascinated with what David Rowe VK5DGR does, and the insights he leaps to, such as his use of a Raspberry Pi as a real world transmitter, and the idea of a Time Division Duplex (TDD) single-frequency repeater. I hope both of those evolve beyond the ideas and experiments stage.

I fully agree that we desperately need to rethink the technical and operational (and frequency usage / protection) of VHF / UHF repeaters. I fully agree that we need to treat the "20 kHz" bandwidth of a repeater as a multi-mode mini-transponder. It's fascinating to see what our fellow hams in Europe are doing with the QO-100 geostationary satellite with only a relatively narrow transponder there. They're having a lot of fun with data *and* digital voice.

Dave Bengtson KE7HYY, in a Substack comment for Zero Retries 0009 - New Paradigm Network Amateur Radios - Part 3:

> I was inspired by some of the discussions here, and have started to sketch out a hardware front end for some of the TX capable SDR's. The HackRF One/Blade RF/Lime SDR/USRP's all support TX/RX up to a couple of GHz. I'm starting with 2meters, and am thinking about a small box that would have RX/TX SMA inputs and an ANT output, with 5W of transmit power for the 2m band. I'm still sketching ideas out, and am open to suggestions.

KE7HYY - Great to hear that you're inspired! Of the units you listed, a knowledgeable friend says that the Blade RF is the best bang-for-the-buck. If you could get a driver amplifier that would get the RF output up to 5 watts, then a conventional power amplifier could get the

transmit power up to a usable 25 watts or so. Keep us posted on your progress!

Closing The Channel

As of 2021-09-13, Zero Retries is now on Twitter - @zeroretries. I'm not yet *very* active there, but I'll try to pay attention.

A commenter in Reddit pointed out that I should disclaim that the views I express in about Amateur Radio in Zero Retries are mostly about Amateur Radio in the US. That comment is correct, thus consider it disclaimed that Zero Retries has a US-centric perspective of Amateur Radio. I do my best to think of "rest of world" Amateur Radio in my writing, but I'm not there in other parts of the world, so if I say something blatantly inaccurate, please call me out.

If you're enjoying Zero Retries, please tell your friends and co-conspirators. For the immediate future, Zero Retries will remain an experiment in progress. Feedback is easy if you're reading Zero Retries in email - just hit Reply and I'll get your email. Or you can go to the web version of any Zero Retries issue, scroll to the bottom, and post a comment on the web version of a Zero Retries issue. I'm especially interested in content ideas about things that you'd like to see discussed in Zero Retries. If you know of "Zero Retries Interesting" projects, groups, activities, etc. please let me know. I do reply to every Zero Retries email I receive.

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc. There is no "text only, no instrumentation" version of Zero Retries available. I don't use such information in any way other than (in the absence of much feedback) getting some satisfaction that the data shows that people actually do read Zero Retries.

All previous issues of Zero Retries are available without restriction (no paywalls). For some background on Zero Retries, Issue 0000 was The Introduction Issue.

Thanks for reading!
Steve Stroh N8GNJ
Bellingham, Washington, USA
2021-09-24
If you'd like to reuse an article in this issue, for example for club or other newsletters, just ask. Please provide credit for the content to me and any other authors.
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Below is a much more complete "footer" that has evolved over 30+ issues of ZR.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, here are some pointers:

- **Ham Radio for Dummies** by Ward Silver N0AX is a great overview of Amateur Radio. N0AX is a gifted writer and HRFD is now in its 4th edition.

- My two favorite **YouTube** channels for a good overview of Amateur Radio are AmateurLogic.TV. and Ham Nation (part of Ham Radio Crash Course). These folks just seem to have so much fun!

- Radio Amateur Training Planning and Activities Committee (**RATPAC**) offers weekly presentations on general Amateur Radio topics (Wednesdays) and emergency communications in Amateur Radio (Thursdays).

- Dan Romanchik KB6NU offers a free **No-Nonsense Study Guide** for the Technician test (PDF).

- HamExam.org Amateur Radio Practice Exams offers good **Flash Card and Practice Exams**.

- When you're ready to take an **Amateur Radio examination** (Tech, General, or Extra), W1MX - The MIT Amateur Radio Society offers remote exams, free for students and youngsters. *There are apparently many other remote exam options*.

Bonus - with an Amateur Radio license, you'll be more attractive on dates 😀

Closing the Channel

- In its mission to grow Amateur Radio and make it more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex!

- My ongoing Thanks to Tina Stroh KD7WSF for, well, *everything* and Bill Vodall W7NWP as *Zero Retries Instigator in Chief*.

- My ongoing Thanks to pseudostaffers Dan Romanchik KB6NU and Jeff Davis KE9V for continuing to spot, and write about "Zero Retries Interesting" type items, on their respective blogs, from Amateur Radio and beyond, that I don't spot on my own.

- Southgate Amateur Radio News consistently surfaces "Zero Retries Interesting" stories.

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More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ (He / Him)
These bits were handcrafted in beautiful Bellingham, Washington, USA

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